Space Weather Forecast

Issued on Thursday, 27 April 2023 at 13:22 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1 Minor/G2 Moderate Geomagnetic Storms decreasing through period. Increased chance of Moderate X-ray flare activity and R1 Minor/R2 Moderate radio blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity rose to moderate over the past 24 hours, with X-ray activity peaking with a low-end moderate-class flare at 27/1113UTC from a sunspot region in the middle of the Sun, otherwise seeing occasional Common-class activity. There was no concurrent obvious Coronal Mass Ejection (CME) generated, however this aspect will be monitored.

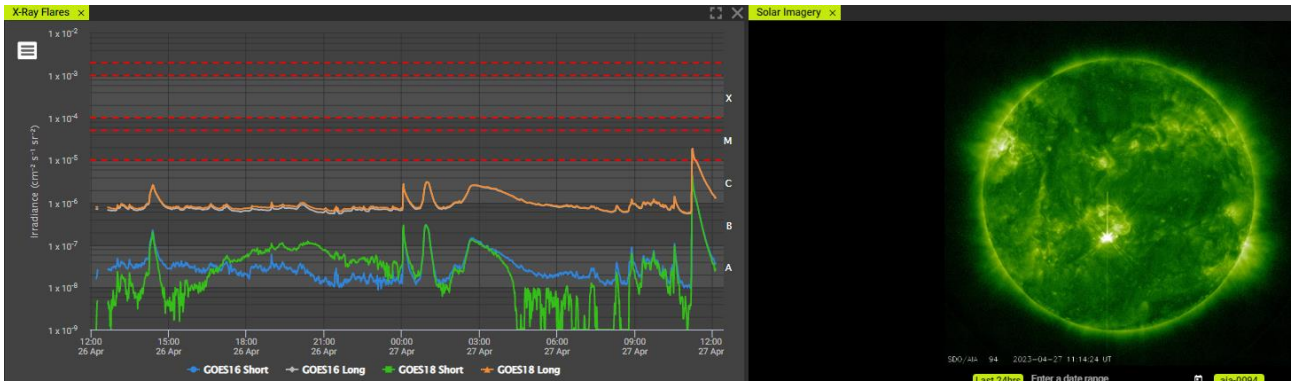

Figure 1: X-ray trace from a near-Earth satellite and false colour extreme UV satellite imagery for flares over the past 24 hours, showing the 27/1113UTC event near the centre of the facing side.

Flare activity was roughly split between two of the seven sunspots on the Sun. The first took the form of a growing magnetically bipolar region in the south-centre of the Sun, with its intermediate spots appearing and increasing in size. The second sunspot group of note appeared to be more stable in terms of growth trends, manifesting as a bipolar region in the northeast, although the narrow viewing angle may be concealing detail.

Other noteworthy flares of the 24 hours was seen from the sunspot in the northeast at 27/0058UTC, with this flare perhaps providing the impetus for one of the most significant events around an hour later - a large 'filament eruption' to its immediate southwest. A provisional analysis has been conducted of this event, and it appears to most likely to lag the Earth in the track of its orbit to no effect. Further analysis will be attempted should improved satellite imagery for the period become available.

A number of possible Coronal Mass Ejections (CMEs) have been seen leaving the northeastern solar horizon in the past 36 hours or so - while some are perhaps attributable to the vicinity of the visible sunspot here, there appears to be a source further north and east that may reveal itself here

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into the coming UTC weekend.

Of the remainder of the seven sunspot regions on the Sun, only those just east of the solar meridian showed any growth becoming more congested (with constituent spots) in the period.

Solar Wind / Geomagnetic Activity: The solar wind showed the onset of a fast wind regime in the 24 hours, beginning around 26/1800UTC.

The solar wind speed rose from elevated levels to peak at strong. The number of particles in the solar wind was slightly elevated prior to the coronal hole's onset, but has since fallen to more typical background levels. The associated magnetic field also rose to a slightly elevated peak shortly before 26/1800UTC, since falling to background levels with a steady tendency. The north-south component of this field displayed a changeable character, but with no protracted aligned or anti-aligned periods (with Earth's field) observed.

The net effect of the above solar wind measures was for disturbed geomagnetic activity, but below Minor Geomagnetic Storm G1 throughout.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain low, with a now increased chance of reaching Moderate levels. No significant regions leave and no returning regions are due to alter this forecast, leading to a flat trend. Possibly complicating this, CME activity from the northeast of the Sun may yet reveal a newly-developed region here that may factor into probabilities later this week.

Solar Wind / Geomagnetic Activity: Up to three CMEs feature in the forecast. Firstly, a 'filament eruption' (arc of plasma) on 24 April produced a CME which may soon deliver a glancing blow at Earth, although confidence in this occurring at all is now reduced. Secondly and thirdly, further 'filament eruptions' on 25-26 April gave CMEs which are considered most likely to miss, but there is a very low risk of a glancing blows during Days 2 and 3 (28 and 29 April).

The fast wind 'coronal hole'-driven forecast is otherwise for solar wind speeds currently at strong levels to continue for much of the period, although reducing in strength and perhaps fading entirely later in the UTC weekend.

All considered, Day 1 geomagnetic activity is expected to carry a chance of G1/Minor Storm conditions, and perhaps still a surviving slight chance of a G2/Moderate Storm, should the CME arrive soon and with its associated magnetic field strongly anti-aligned with Earth's. Activity is then likely to generally wane through Days 2, 3 and 4, although the risk of further CME glancing blows on Day 2 and 3 may prolong a slight chance of G1 intervals.

Energetic Particles / Solar Radiation: No solar radiation storms are expected, with a very slightly increasing chance in the four days due to typical westward advance of all contributing solar regions. The recent Moderate class X-ray flare has very slightly increased the chances of a solar radiation storm in the coming 12 hours or so, although this remains unlikely.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	20	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	2	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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